provided the rotation be sufficiently rapid. If a thicker piece of quartz be used, giving two, three, or four dark bands, the rotation-spectrum will present a most beautiful appearance, being crossed by a two-branched, or three-branched, or four-branched spiral, the separate lines of which proceed from the centre to the circumference. The sense of these dark spirals will change with the sense of the impressed rotation. The effects are very striking.

SEVERAL ingenious contemporaries of ours on this side of the Atlantic have furnished the eager appetites of their readers with diagrams of Graham Bell's photophone, of which the most casual observer cannot fail to notice the utter want of resemblance to one another. More than one at least of these is *ben trovato*.

LIQUID OZONE has been obtained by MM. P. Hautefeuille and J. Chappuis, and is found to be of a beautiful blue colour. If a mixture of oxygen and ozone at a temperature of about – 23° or – 25° be subjected to a considerable pressure, the ozone liquefies and will remain liquid even though the pressure be reduced to 10 atmospheres. Experiments involving alterations of pressure must however be carefully made; for the ozone is liable to change into oxygen with a sudden evolution of heat, producing an increase of pressure with explosive violence. It is necessary to interpose a layer of sulphuric acid upon the top of the column of mercury by which the pressure is applied in the instrument, as ozone acts directly on the mercury.

HERR HANKEL has recently (*Wied. Ann.*, No. 8) endeavoured to prove the direct transformation of vibrations of radiant heat into electricity. He had formerly shown that rock crystal has thermoelectric polar axes in the direction of its secondary axes (the six successive poles being alternately positive and negative), and he supposes the ether within the crystal to be so arranged that under influence and with participation of the material molecules it is movable in circular paths round the secondary axes, and more easily movable in one direction than in the other. Thus all along a secondary axis the more easily occurring rotation has the same direction, but looked at from without, the direction is opposite at one end to what it is at the other, so giving the opposite modifications of electricity. When radiations from without strike along such an axis, those vibrations in them whose direction coincides with that of the easier rotation of the ether-molecule in the crystal should induce rotation of this along with the material molecule, and at the two ends of the secondary axis there should be electric tensions, with opposite electricity. Herr Hankel verified this by placing an insulated metallic ball connected with a gold-leaf electroscope in the middle of one edge of a rock crystal fixed with its principal axis vertical, while sunlight was thrown from the other side along the secondary axis terminating at the ball; then the arrangement was reversed. The electroscope indicated opposite electricities in the two cases. A gas-flame or a heated ball gave similar effects, which, moreover, were proved to be due to the dark heat rays (not to the luminous rays).

THE specific rotatory power of paraglobulin in blood serum is 47°·8 for yellow light; that of albumen, 57°·3. As these are the only albuminoid substances present in any considerable quantity, two determinations with the aid of the polaristrobometer suffice (as M. Fredericq has shown to the Belgian Academy) for ascertaining their relative proportions. The rotation produced by the whole liquid is first determined; then the paraglobulin is precipitated with $MgSO_4$, then redissolved in a volume of water equal to that of the original serum, and the rotation-number got from this is deducted from that got previously. Each of the numbers divided by that representing the specific rotatory power of the corresponding substance indicates the quantity of the substance in 100 cc.

IN a recent brief memoir to the *R. Accademia dei Lincei* (*Atti*, June, 1880), Dr. Bartoli describes an ingenious application of the Bunsen calorimeter to determination of the mechanical equivalent of heat. A given mass of mercury at zero temperature is subjected to a considerable pressure, exactly determined, and passed through a steel tube of so small internal diameter and such length that its velocity of outflow is virtually *nil*, and so the work equivalent to the kinetic energy of the mercury issuing from the tube becomes negligible in presence of the work consumed by friction between the mercury and the walls of the tube. This tube penetrates into a metallic cylinder situated within the reservoir of the Bunsen calorimeter. The quantity of ice melted in the calorimeter serves as measure of the heat developed by the work of efflux of mercury. It is stated that the numerical results are noteworthy for their agreement with the mean of former determinations, and still more for the narrow limits between which the extreme values arrived at are comprised.

EXPERIMENTS with regard to interpretation of the unequal reversal of magnesium lines in the green part of the solar spectrum are detailed by M. Fiévez in a recent paper to the Belgian Academy (*Bull.* No. 8). He first examined the influence of relative intensity of bright magnesium lines on their visibility by observing them separately and projecting them on the solar spectrum. Then he repeated the experiments of simplification of the spectrum by varying the intensity of the spark. Lastly, he studied the influence of greater or less dispersion and definition on the number and visibility of the lines, comparing prismatic with diffraction spectra. The experimental arrangements were mainly the same as in his recent researches on the spectra of hydrogen and nitrogen. The conclusion he arrives at is that the unequal reversal in question is due merely to a difference in the intensity of the bright lines, not to a dissociation of the metal.

M. BOUTY considers he has proved (*Journal de Phys.*, September) that in simple electrolysis the Peltier phenomenon is produced according to the same laws as at the surface of contact of two metals. It is a purely physical phenomenon without known relations with the heat of combination, or with the latent heat of solution, but connected by a precise law with the thermo-electric forces of corresponding couples. Chemical actions intervene in the production of one or other of the two inverse phenomena merely as disturbing causes, either altering the nature of the surfaces or producing a secondary liberation of heat. They may mask, more or less, the phenomenon on which they are superposed, but they do not produce it.

GEOGRAPHICAL NOTES

MR. LEIGH SMITH, during his Arctic cruise in his yacht *Eira*, has evidently done some very good work this summer. After cruising about the east coast of Greenland and in the neighbourhood of Spitzbergen, finding the ice-pack too dense and too far south to get far north without danger—although he reached 79° 40′ N. in 46° 50′ E., the farthest point yet reached in that direction—Franz-Josef Land was reached on August 14. Here much exploring work was done. Land was found stretching away west and north-west from that discovered by the Austrians. A fine harbour, called after the *Eira*, was found in 80° 5′ 25″ N., 48° 50′ E., and several excursions were made from this basis, among the numerous fjörds that pierce the mainland north and north-west. From the point named by the last Dutch expedition Barentz Hook, land was traced westwards some 110 miles, and from the extreme north-west point reached land was sighted forty miles further north-west. In the sea between were several large and small islands, all covered with glaciers and snow-fields, with bluff black headlands on the southern exposure, covered with vegetation. Several Arctic flowers were collected and brought home; a number of soundings and dredgings were made, yielding interesting results, and two bears which were caught have been sent to the Zoological Gardens. Evidently there is here a considerable archipelago, if not continuous stretch of land, giving some support to Petermann's theory that the Pole is probably surrounded by numerous islands. It is stated that Mr. Leigh Smith goes back next year; we trust he will reach Eira Harbour early, and be able to still further extend our knowledge of these new Arctic lands.

THE October number of *Petermann's Mittheilungen* contains several good papers. There is an interesting account of the progress of the Japanese trading station in Corea, which now contains about 2,000 Japanese inhabitants. Important information is given as to the results of Dr. O. Finsch's voyage in the Pacific. During a stay in the Sandwich Islands he made considerable additions to our knowledge of their natural history; thence he went to Jabut (Bonham) in the south of the Marshall Group, where his collections and observations in all directions were numerous and of great value. Thence he proceeded to the Gilbert or Kingsmill Group, and afterwards to the Carolines. Some idea of the results so far may be obtained from the fact that he has sent to Europe something like thirty boxes of collections; the materials collected in ten months embrace 70 mammals, 180 birds, 800 reptiles, 1,200 fishes, 15,000 molluscs, 800 crustaceans, 400 spiders, 1,400 insects, and about 150 other animals, besides 700 plants, and two boxes of minerals. In anthropology there are 50 skulls and 55 casts of faces, representing the peoples

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of 20 different islands, besides 1,500 ethnographical objects. Dr. Hann contributes "Some Results of Recent Meteorological and Hypsometric Observations in Equatorial East Africa;" Col. Mason-Bey, a detailed account of Dar-fur; and Prof. Ratzel, a paper on the Formation of Fjörds in Inland Seas.

UNDER the title of "Some Heroes of Travel," the Society for Promoting Christian Knowledge has issued a volume by that versatile and successful compiler Mr. Davenport Adams. It contains the stories of Marco Polo, G. F. Ruxton (Mexico and the Rocky Mountains), Barth, T. W. Atkinson (Siberia and Central Asia), Miss Tinné, Mr. McGahan, Col. Warburton, (Australia), Major Burnaby, and Sir Samuel Baker. Mr. Adams seems to have done his work conscientiously, and the book is likely to interest youthful readers and those fond of tales of adventure.

VOL. V. of Dr. Robert Brown's "Countries of the World" (Cassell) includes Siberia, the Chinese Empire, Burmah, and the other countries of the Indo-Chinese peninsula, India and neighbouring countries, Central Asiatic States, Russian Central Asia, and Persia. The new volume is quite up to the mark of the previous ones, and the numerous illustrations are well selected.

M. E. S. ZEBALLOS, writing from Buenos Ayres to *L'Exploration*, states that he has returned from the exploration of the Pampas of the Argentine Republic, and instead of finding them the featureless dead level which they are usually described, he discovered majestic mountains, lakes, rivers, and other features, which will materially change the map of South America. M. Zeballos kept minute records of his expedition, topographical, descriptive, scientific, meteorological, &c., which we hope will be placed within the reach of European geographers.

IN the last number of the *Bulletin* of the Eastern Siberian (Iskutsk) Section of the Russian Geographical Society is the continuation of the Report of M. Tcherski of the results of his three years geological exploration of the neighbourhood of Lake Baikal.

THE fourth Belgian expedition, under Capt. Raemackers, had got well into Central Africa from Bagamoyo by the end of August.

THE FIRST DECADE OF THE UNITED STATES FISH COMMISSION—ITS PLAN OF WORK AND ACCOMPLISHED RESULTS, SCIENTIFIC AND ECONOMICAL[1]

THERE are now no less than nine departments of the Government devoted, in part or wholly, to researches in pure and applied science—the Geological Survey, the Coast and Geodetic Survey, the Naval Observatory, the National Museum, the Department of Agriculture, the Entomological Commission, the Tenth Census, with its special agencies for the study of the natural resources of the country, the Smithsonian Bureau of Ethnology, and the Commission of Fish and Fisheries. The Smithsonian Institution, established upon an independent foundation, should also be mentioned, as well as the Medical Museum of the Army and the various laboratories under the control of the Army and Navy Departments.

The Geological Survey is not now carrying on any of the schemes of zoological and botanical investigation engaged in by its predecessors.

The work of the Entomological Commission and that of the Census, though of extreme importance, are limited in scope and duration, while that of the Agricultural Department is necessarily, for the most part, economical.

The work of the National Museum is chiefly confined to the study of collections made by Government Surveys, or individual collectors, as sent in to be reported upon.

The work of the Fish Commission, in one of its aspects, may perhaps be regarded as the most prominent of the present efforts of the Government in aid of aggressive biological research.

On the 9th of February, 1871, Congress passed a joint resolution which authorised the appointment of a Commissioner of Fish and Fisheries. Prof. Baird, at that time Assistant-Secretary of the Smithsonian Institution, was appointed, and entered at once upon his duties.

The summer of 1880 marks the tenth season of active work since its inception in 1871. The Fish Commission now fills a place tenfold more extensive and useful than at first. The present essay aims to show, in a general way, what it has done, is doing, and expects to do—its purposes, its methods, its results.

The work is naturally divided into three sections—

1. The systematic investigation of the waters of the United States and of the biological and physical problems which they present.—In making his original plans the Commissioner insisted that to study only the food-fishes would be of little importance, and that useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character. The life-history of species of economic value should be understood from beginning to end, but no less requisite is it to know the histories of the animals and plants upon which they feed, or upon which their food is nourished; the histories of their enemies and friends, and the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in their relation to migration, reproduction, and growth. A necessary accompaniment to this division is the amassing of material for research to be stored in the National and other Museums for future use.

2. The investigation of the methods of the fisheries of the past and present, and the statistics of production and commerce in fishery products.—Man being one of the chief destroyers of fish, *his* influence upon their abundance must be studied. Fishery methods and apparatus must be examined and compared with those of other lands, that the use of those which threaten the destruction of useful fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable. Statistics of industry and trade must be secured for the use of Congress in making treaties or imposing tariffs, to show to producers the best markets, and to consumers where and with what their needs may be supplied.

3. The introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general Government, or those common to several States, none of which might feel willing to make expenditures for the benefit of the others.

Although activity in this direction may be regarded in the light of applied rather than pure scientific work, it is particularly important to the biologist, since it affords opportunities for investigating many new problems in physiology and embryology.

Since the important fisheries centre in New England the coast of this district has been the seat of the most active operations in marine research. For ten years the Commissioner, with a party of specialists, has devoted the summer season to work at the shore at various stations along the coast from Connecticut to Nova Scotia. A suitable place having been selected, a temporary laboratory is fitted up with the necessary appliances for collecting and study. In this are placed from ten to twenty tables, each occupied by an investigator, either an officer of the Commission or a volunteer. From 1873 to 1879 important aid was rendered by the Secretary of the Navy, who detailed for this service a steamer to be used in dredging and trawling, and this year the steamer built expressly for the Commission is employed in the same manner.[1]

The regular routine of operations at a summer station includes all the various forms of activity known to naturalists: collecting along the shore, seining upon the beaches, setting traps for animals not otherwise to be obtained, and scraping with dredge and trawl the bottom of the sea at depths as great as can be reached by a steamer in a trip of three days. In the laboratory are carried on the usual structural and systematic studies, the preparation of museum specimens and of reports. Since the organisation of the Commission the deep-sea work and the investigation of invertebrate animals has been under the charge of Prof. Verrill, who had for many years before the Commission was established been studying independently the invertebrate fauna of New England.

In addition to what has been done at the summer station, more or less exhaustive investigations have been carried on by smaller parties on many parts of the coast and in interior waters.

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[1] Read before the American Association for the Advancement of Science, Boston, August 28, 1880, by G. Brown Goode.

[1] The number of dredging and trawling stations on record is as follows:--

1871.	Wood's Holl	345
1872.	Eastport. 200 by hand, 36 by steamer	236
1873.	Portland	149
1874.	Noank...	223
1875.	Wood's Holl	169
1877.	Salem	378
,,	Halifax	
1878.	Gloucester	
1879.	Provincetown	
		1,500

The number of seine hauls is about 600.

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